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ACTIVITIES OF THE UNITED STATES  
IN THE FIELD OF BIOLOGICAL WARFARE

A Report to The Secretary of War

by

George W. Merck,

Special Consultant on Biological Warfare

#39

MERCK REPORT  
ON BIOLOGICAL WARFARE

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**PART ONE**

**ORIGINS AND DEVELOPMENT OF**

**A BIOLOGICAL WARFARE PROGRAM**

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**Definition of Biological Warfare.**

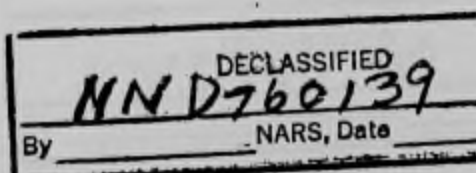
Biological warfare may be defined as the employment of bacteria, fungi, viruses, rickettsias, and toxic agents derived from living organisms (as distinguished from synthetic chemicals used as gases or poisons) to produce death or disease in man, animals, or growing plants.

**Strategic Possibilities of Biological Warfare.**

Biological warfare still remains in the realm of theory rather than fact since no military power has ever used it on a scale larger than sabotage; hence conclusions regarding its potentialities must be deduced from laboratory experiments and field tests and not from actual military experience. It is believed possible that biological warfare agents which can be produced on a large scale might be effectively dispersed in combat weapons or used by saboteurs. Certain biological warfare agents injure by poisoning or intoxicating humans or animals, others, by multiplying in susceptible individuals, thereby causing infectious diseases; in either case, only minute quantities of the agent need be used. For this and other reasons, it would be extremely difficult for the recipient of a biological warfare attack to detect with rapidity and accuracy the specific agent employed by the attacker.

Large numbers of civilian or military personnel, animals, or extensive areas of farm crops might be affected by biological warfare attacks. A secondary effect of potential significance would be the diversion of military resources and manpower to care for the ill and to control epidemics which might be started. It is obvious that any military power which might employ biological warfare would have to possess means of protection against the agents used. It is possible that biological warfare agents

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might be used to charge conventional munitions or that they might be placed in rockets, flying bombs, or balloons which could be directed against a country from great distances and without warning. With these possibilities in mind, it is believed important to describe in a general manner the work which has been done on biological warfare in the United States, and in co-operation with our British and Canadian allies.

General Background Before World War II.

In the years between World Wars I and II considerable interest was shown among both scientists and military men of many countries in the general subject of biological warfare. In 1941 officers of the Chemical Warfare Service, working with a special committee of the National Academy of Sciences known as the WBC Committee, compiled an annotated bibliography of the literature published on biological warfare up to that time. This bibliography contained over 200 titles of papers dealing mainly with speculation regarding the possibilities of biological warfare. The authors of this bibliography stated: "An analysis of the opinions expressed by the authors of articles under consideration reveals that the great majority believe that biological warfare is possible or probable in the future. In addition, a significant number assert emphatically that this arm will be used, the opposite view being held by but relatively few individuals."

Much of the speculation and expression of opinion which appeared in print between 1918 and 1941 was based on incontrovertible evidence that German agents, working in the United States during 1915, used cultures of disease-producing bacteria to inoculate horses and cattle leaving the United States ports for shipment to the allies. It was also an established fact that German agents attempted to cause infectious diseases in cavalry horses

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in the Rumanian Army at the time when Rumania entered the first World War. The discussions of the potentialities of biological warfare were based largely on these established facts.

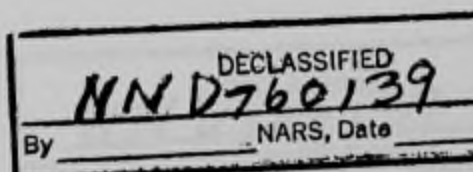
In 1934 Wickham Steed, a British journalist, wrote a highly sensational article based on documents in his possession which he claimed had been extracted from the files of the German General Staff. These papers described experiments made to determine whether non-pathogenic microorganisms might be disseminated in the ventilating systems of the London and Paris subway systems. Although the Steed articles brought forth a prompt and vehement denial from German quarters, and although the authenticity of the documents which he claimed to possess was never proven, the disclosures created a very considerable sensation at the time and stimulated further speculation on the whole subject of biological warfare.

There is evidence that in the years between the two wars, the general staffs and scientists of several countries were seriously concerned with the strategic potentialities of biological warfare. Although experimentation in this field was undoubtedly carried on in secret, and the evidence available was based largely upon rumor, there was a sufficient quantity of intelligence on hand in 1941 to cause responsible authorities in the United States to consider very seriously the dangers of biological warfare. This was particularly true in the months immediately preceding Pearl Harbor.

Early Steps Taken by the United States Government to Investigate the Possibilities of Biological Warfare.

Before there was any unification of plans or activity in the investigation of biological warfare in the United States, several agencies or branches of the Government considered this subject independently. The reports of these individuals or groups form the logical beginning of an

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account of the Government's activities. In 1933 Major (now Brig. General) Leon Fox, MC, USA, then Chief of the Medical Section of the Chemical Warfare Service, surveyed the possibilities of biological warfare and printed his opinions in one of the most comprehensible and complete papers on this subject. It was his opinion that the difficulties of producing microorganisms or their poisonous products on a large scale and of storing these agents so that they might maintain their disease-producing power made biological warfare more theoretical than practical. In 1937 Lt. Colonel (now Brig. General) James S. Simmons, MC, USA, pointed out the possibility that potential enemies of the United States might drop insects infected with disease-producing organisms on our territory in order to cause an epidemic. This opinion was brought to the attention of the War Department only informally but served to create additional interest in the subject of biological warfare.

In 1940 a meeting of scientists was called at the National Institute of Health of the United States Public Health Service to consider the possibility of a biological warfare attack on the United States. This subject had also been discussed by the Council of National Defense and by the National Research Council. Opinion at that time was divided but it was generally believed that biological warfare did not constitute a significant menace to the United States. However, this method of attack was considered as a possibility.

Independent of this early interest of the United States Public Health Service, officers on the staffs of the Surgeons General of the Army and Navy had also indicated concern over the possibility of enemy use of biological warfare. G-2 of the Army had also explored the subject, and the Chemical Warfare Service had directed a small group of officers to study the possibilities of biological warfare.

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The interests of these separate groups were soon joined. On July 15, 1941, the Surgeon General of the Army suggested that a committee of scientists be formed to review the subject. Before action was taken on this request, the Office of the Secretary of War had begun an independent exploration of means by which the branches of the military services might most effectively coordinate their efforts in considering the problem of biological warfare. This resulted in a meeting being called by Mr. Harvey H. Bundy, Special Assistant to the Secretary of War, which brought together representatives of the Office of the Surgeon General; Chemical Warfare Service; National Research Council; ACoFS, G-2; and the Committee on Medical Research of the Office of Scientific Research and Development. A report of this meeting was submitted to the Advisory Council of the Office of Scientific Research and Development. The OSRD Council recommended that the Secretary of War request the National Academy of Sciences to investigate the possibilities of biological warfare. In accordance with this suggestion, on October 1, 1941 the Secretary of War wrote the President of the National Academy of Sciences as follows:

"Because of the dangers that might confront this country from potential enemies employing what may be broadly described as biological warfare, it seems advisable that investigations be initiated to survey the present situation and the future possibilities. I am therefore asking if you will undertake the appointment of an appropriate committee to survey all phases of this matter. Your organization already has before it a request from the Surgeon General for the appointment of a committee by the Division of Medical Sciences of the National Research Council to examine one phase of the matter. I trust that appropriate integration of these efforts can be arranged."

As a result of this request, the President of the National Academy of Sciences and the Chairman of the National Research Council asked Dean (now President) E. B. Ford of the University of Wisconsin to serve as chairman and to help form a committee which was designated later as the WBC Committee.\*

\*-Lists of persons, committees, and institutions participating in the work on biological warfare described in this report are contained in the appendices.

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The WBC Committee of the National Academy of Sciences.

The WBC Committee was organized rapidly and initiated its investigations almost immediately. Liaison officers were appointed to serve with the committee from the Office of the Surgeon General, the Chemical Warfare Service, the Bureau of Medicine and Surgery of the Navy, the U. S. Department of Agriculture and the U. S. Public Health Service. The purpose of the Committee was defined as follows: "The purpose of the Committee is conceived to be a consideration of those biological agents that may be purposely used to produce a harmful effect on man, animals, plants or food supplies, and methods of control of these agents. In terms of war, this means a study of both offensive and defensive methods relating to biological warfare." Intensive work was initiated and two meetings of the full Committee were held in rapid succession. Conferences were held on problems of mutual concern with the Canadian committee which was at work in this same field. These resulted in a recommendation late in December 1941 that steps be taken to minimize the danger of the introduction into the North American Continent of certain diseases of live-stock, and that facilities be provided for research and development work on the preparation of vaccines needed to protect animals against these diseases. These recommendations lead to the formation by the Governments of the United States and Canada of a Joint United States-Canadian Commission to administer the work which was later carried on in this field.

Following a third meeting of the WBC Committee in February 1942, a report was sent to Dr. Frank B. Jewett, President of the National Academy of Sciences, who transmitted it immediately to the Secretary of War. The report stated: "(1) that biological warfare is regarded as distinctly feasible. We are of the opinion that steps should be taken to formulate

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offensive and defensive measures. (2) Your attention is called to the wide variety of subject matters considered in this report and to the consequent implications that several different government agencies might be concerned in offensive or defensive biological warfare. (3) A covering recommendation is that appropriate means be provided for carrying out the recommendations. (4) Important diseases of man, animals and plants and modes of contaminating food and water supplies have been considered from the standpoint of biological warfare and specific recommendations regarding these diseases and the dissemination of the agents of disease have been made in the body of this report. These recommendations are submitted for your information and without presumption as to the ways and means of putting them into effect." The Committee also pointed out that "The value of biological warfare will be a debatable question until it has been clearly proven or disproven by experience. The wise assumption is that any method which appears to offer advantages to a nation at war will be vigorously employed by that nation. There is but one logical course to pursue, namely, to study the possibilities of such warfare from every angle, make every preparation for reducing its effectiveness, and thereby reduce the likelihood of its use."

After submission of the report the Chairman and members of the Committee worked vigorously to lay the groundwork for further investigation of the problem. The Chemical Warfare Service liaison officer to the Committee was sent, on invitation from British officials, to the United Kingdom to explain the interests of the United States and to obtain suggestions from responsible British scientists who had been carrying on investigations in this field since early 1940.

The report of the WBC Committee was referred by the Secretary of War to the General Staff with the suggestion that it should receive thorough

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study. The results of the General Staff's deliberations and the subsequent action by the War Department are best explained by quoting a letter of the Secretary of War to the President of the United States under date of April 29, 1942:

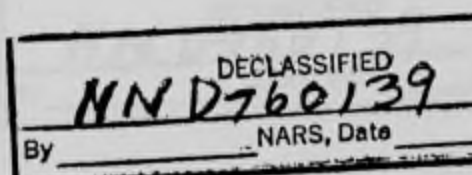
"Some time ago it was called to my attention through my representative in the Office of Scientific Research and Development, of which Dr. Bush is the Director, that there might be serious dangers to this country from what might be described as "Biological Warfare." It seemed well to make a preliminary investigation with great secrecy. Accordingly, I asked Dr. Jewett of the National Academy of Sciences to form a Secret Committee of eminent biologists to consider the question. Such a committee was appointed, including a number of the most important biologists in the country among whom were Dr. Edwin B. Ford of Wisconsin, Dr. Stanhope Bayne-Jones of Yale, as well as others from Johns Hopkins and the Rockefeller Institute.

"This committee has made an extensive study and a very thorough report in which it points out that real danger from biological warfare exists both for human beings and for plant and animal life. The committee recommends prompt action along a number of lines, some involving the development of vaccines, some dealing with scientific techniques of defense. Others involve protective measures such as water supply protection, and still others require further research. The matter which the committee considered as requiring most immediate attention is the great danger of attacks on our cattle with the disease of "Rinderpest", which has been at times most destructive in the Philippines.

"Biological warfare is, of course, "dirty business" but in the light of the committee's report, I think we must be prepared. And the matter must be handled with great discretion and for the most part with great secrecy as well as great vigor. The immediate question is through what agency of the Government and under what individual leadership this should be started. I am confident that a single able man as director is one of the first essentials.

"Some of the scientists consulted believe that this is a matter for the War Department but the General Staff is of the opinion that a civilian agency is preferable, provided that proper Army and Navy representatives are associated in the work. It is evident that the matter deals primarily with the Public Health and to some extent with matters ordinarily in charge of the Department of Agriculture. Entrusting the matter to a civilian agency would help in preventing the public from being unduly exercised over any ideas that the War Department might be contemplating the use of this weapon offensively. To be sure, a knowledge of offensive possibilities will necessarily be developed because no proper defense can be prepared without a thorough study of means of offense. Offensive possibilities should be known

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to the War Department. And reprisals by us are perhaps not beyond the bounds of possibility any more than they are in the field of gas attack for which the Chemical Warfare Service of the War Department is prepared.

"It seems to me that an appropriate place in which to establish this work would be a separate branch of the Social Security Agency under Mr. McNutt but I have not taken this matter up with him until you have had an opportunity to consider the matter.

"The choice of the right man to be put at the head of this activity seems to me perhaps more important than where it is established in the Government.

"Having asked for the report and having now received the disturbing warnings to which I have made reference and especially in view of the recommendation for immediate action, I should appreciate it if you would advise me of your wishes in order that such action as you wish may be promptly taken."

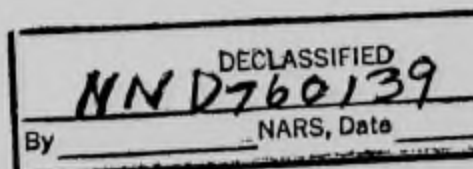
#### Formation of War Research Service.

On May 15, 1942 the President gave his verbal approval to the proposals in this letter, and as a result of his decision, and the subsequent recommendations of the WBC Committee in June, 1942, the civilian agency recommended by the Secretary of War was organized in the Federal Security Agency under the title of War Research Service. Mr. George W. Merck was appointed Director. It was decided that all work on biological warfare should be done under the strictest security control.

#### Early Decisions of War Research Service.

The Director of War Research Service was put in full control of all aspects of biological warfare. He was made specifically responsible for defensive measures against possible enemy attack and for the development of practicable retaliatory offensive measures. A grant from the President's Special Emergency Fund was given to WRS; all financial matters were handled by a specially appointed representative in the Federal Security Agency. It was the responsibility of WRS to organize an entirely unknown field of research and development since all aspects of biological warfare were still

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purely theoretical. This posed two immediate problems:

1. Should War Research Service be organized as a large independent agency with its own research laboratories and facilities? Or,
2. Should War Research Service be a coordinating agency, making use of the facilities, personnel, and experience already existing in the Government and in other institutions?

For reasons of efficiency, economy and security, the second alternative was adopted.

War Research Service was set up as a small organization. Under Mr. Merck, Dr. E. B. Fred was appointed Director of Research and Development, and Mr. J. P. Marquand was made Director of Information and Intelligence. A small staff of technical aides and secretaries was formed to carry on the administrative work of WRS.

Relation of War Research Service to the  
Armed Forces and Other Government Agencies.

Although never officially connected with the Armed Services, the WRS was from the beginning under the informal direction of the Secretary of War who was represented by his Special Assistant, Mr. Harvey H. Bundy, and no policies were formulated without consulting the Secretary's office. While War Research Service was active in the direction and coordination of nearly all biological warfare matters, the actual orders and directives to implement its recommendations were issued by various branches of the Armed Services. In addition to these informal arrangements, liaison was established with, and cooperation on special problems was requested from, the Navy Department, particularly the Surgeon General; the Office of the Surgeon General of the Army; the Office of the Chief, Chemical Warfare Service; the U. S. Public Health Service; and the Department of Agriculture.

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To secure intelligence on biological warfare, assistance was asked from G-2 of the Army, the Office of Naval Intelligence, the Office of Strategic Services and the Federal Bureau of Investigation. For advice on public relations, working arrangements were established with the Bureau of Public Relations of the War Department, the Director of the Office of War Information, and the Director of the Office of Censorship.

In establishing an anti-biological warfare program in the Hawaiian Islands, liaison was effected with the Department of the Interior. To carry out defensive measures against biological warfare in the United States, WRS secured the cooperation of the Commanding Generals in the Service Commands and established liaison with the Internal Security Division of the Office of the Provost Marshal General which became largely responsible for prosecuting this work in the Service Commands.

Relation of WRS to Our British and Canadian Allies.

In addition to its work with agencies in this country, WRS continued and developed further the cooperative arrangements already established abroad, and consistently exchanged information and personnel with the British b.w. organization as set up under the British Cabinet, and with the b.w. group in Canada.

Scientific Advice From the National Academy of Sciences and the National Research Council.

From the beginning, it was obvious that if War Research Service were to be successful, it would require continuing scientific advice of the highest order. To meet this need, a special committee of scientists, the ABC Committee, was set up by the National Academy of Sciences and the National Research Council to advise War Research Service. Full meetings of the ABC Committee were called only infrequently, but its individual members were consulted as needed on special research matters, and their advice

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proved of the highest importance in the solution of many complex problems.

Activities of War Research Service.

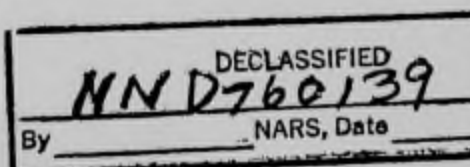
As time went on, WRS found itself involved, usually anonymously, in projects undertaken by these many agencies, both domestic and foreign. Some steps in b.w. were initiated at the direct suggestion of War Research Service and were continued under its guidance; others called only for advice from WRS. Since secrecy and anonymity had to be maintained, the activities of War Research Service are somewhat difficult to define tangibly. Its object was to serve mainly as a catalytic agent, to initiate broad general policies, and to act as a means of achieving liaison between various government departments and branches of the Services in such a way that the b.w. program might be carried out effectively. Thus, War Research Service was concerned with War Department deliberations at the highest levels, particularly in the Office of the Secretary of War, in the Army Service Forces, and in G-2. It participated in the work on b.w. carried on in the Offices of the Surgeons General of the Army and of the Navy, the Office of the Provost Marshal General, and in the deliberations of the Joint Chiefs of Staff concerning b.w. In short, its policy was to be everywhere but nowhere.

This position of War Research Service is well illustrated by the steps which were taken to coordinate defensive measures against the threat of biological warfare attack: its anti-biological warfare program.

Organization of Defenses Against Biological Warfare.

The Director of War Research Service was fortunate in having available the reports and recommendations of the WBC Committee which had previously reported to the Secretary of War, and in having as his Director of Research, Dr. E. B. Fred who had served as Chairman of the WBC Committee.

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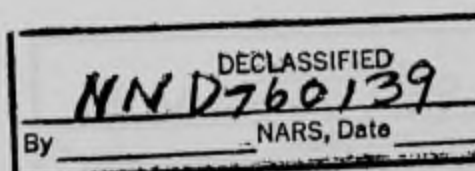
One of the first duties of the Director of WRS was to formulate immediate plans for defensive measures based on the recommendations of the WBC Committee.

It was considered entirely possible that our enemies might possess b.w. weapons for immediate use against our troops and the civilian population. It was decided therefore that steps should be taken promptly to develop defensive measures. Conferences were held with the Commanding Generals of the Service Commands, and programs for the protection of water, food, milk and biological products (vaccines, antisera, etc.) were drawn up and put into effect with the collaboration of the Provost Marshal General and the Surgeon General. Reports of anti-biological warfare officers from the strategic Hawaiian area were examined and evaluated by our scientists, and recommendations were made to the Secretary of War for additional protective measures. In the light of the Hawaiian experience a special survey was made of the Caribbean area which resulted in recommendations for additional protection particularly in the Canal Zone. Finally, all overseas theaters were alerted to the possibilities of a b.w. attack, and specific measures were recommended for the protection of troops.

The WRS Research and Development Program in Biological Warfare.

In the United States, the study of pathogenic agents as weapons of war, and also the study of means of protection against possible enemy use of these agents, was a completely new field of research. The organization of research and development in this field was the primary responsibility of War Research Service, and may be considered as its principal achievement. To determine what pathogenic agents might be used offensively by the enemy, and by ourselves if necessary, and what protective measures might be developed, pre-

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sented a problem that demanded the attention of many minds representing many scientific fields. It was necessary to unify and coordinate this scientific activity and to find immediately laboratory facilities in which these investigations could be started. This task was undertaken by the Director of Research and Development of WRS. Scientists who were recognized as leaders in their respective fields, began forthwith, in consultation with WRS, to discuss and study a long list of pathogenic agents in order to determine those which might be used by the enemy. After these agents had received a preliminary screening, further panels of scientists were set up by WRS to study each agent. Finally, a research project leader for work on each agent was selected, and the panel was asked to determine the laboratory facilities in various universities and research institutions throughout the country which might be used to study the lethal properties, means of production, and methods of protection. Thus, scientific projects were initiated in well-established laboratories throughout the United States. In many cases the services of the scientific personnel in these laboratories were loaned by the universities to the Government. In other cases, the personnel was paid, and all expenses for equipment and supplies were defrayed out of the President's Emergency Fund, through the Federal Security Agency.

Initiation of Large-Scale Research and Development Work on Biological Warfare.

It was inherent in the very nature of b.w. research that certain laboratory investigations might prove fruitless while others might show possibilities. When these potentialities began to show themselves clearly, and when the investigations of certain disease-producing agents and protective measures began to emerge from the laboratory stage, it was necessary to lay plans looking toward pilot plant and field test stages of investigation

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and even toward mass production, though verbal orders were given by the Secretary of War that no stockpiles of lethal materials should be accumulated without his consent.

Almost from the outset it became clear that certain disease-producing agents and protective measures merited particular attention. As research continued in the laboratories, additional items were brought forward for special study, while some proved to be of little value and were dropped from consideration.

As the result of consultations held in the War Department with representatives of the Army Service Forces, it was decided that large-scale developmental work would have to proceed with all possible haste and with maximum security under military protection. Accordingly in November of 1942, the Chemical Warfare Service was requested to cooperate actively in the expanding program of large-scale research and development. War Research Service provided a scientific adviser to the Chemical Warfare Service to direct the scientific aspects of its program in this field and to coordinate its work with that of WRS. Dr. I. L. Baldwin was chosen to fill this important position and was largely responsible for the technological development of the Special Projects Division of the Chemical Warfare Service.

Establishment of a Chemical Warfare Service Research and Development Installation for Biological Warfare Work.

Steps were taken to select a site for a camp in which the necessary laboratory and pilot plant facilities could be built and maintained under strict military security, the small National Guard Airport at Frederick, Maryland known as Camp Detrick was eventually selected for this purpose. Construction of the required experimental facilities and living quarters was started early in April of 1943.

The research and development program which was carried on in the

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Camp Detrick laboratories and pilot plants was the direct responsibility of the Chemical Warfare Service, but the general program of work was continued under the guidance of War Research Service. As time went on, research projects which had been developed in university and governmental laboratories under WRS sponsorship were turned over by WRS to the Chemical Warfare Service. The Camp Detrick installation grew rapidly to meet the increasing needs of this program. It was necessary to construct new laboratories and pilot plants, equip them with the required apparatus, and staff them with trained scientific personnel in a continuing operation of great urgency and complexity. Thus, as the scientific program of WRS and the CWS progressed, the responsibility for getting the job done shifted gradually from civilian to military personnel and organizations. War Research Service continued to play a significant role in the program by sponsoring fundamental research studies in universities and other institutions, and by helping to obtain scientific personnel and equipment for the laboratories and pilot plants at Camp Detrick.

From the beginning, Camp Detrick, though under the supervision of and largely staffed by the Chemical Warfare Service, represented in fact a combined operation with personnel contributed by the Navy, by the Surgeon General of the Army, and from the ranks of qualified civilian scientists. Not only was the program of research and development assigned to Camp Detrick an entirely new and uncharted field of scientific study; but the means by which the Camp was staffed and carried on its activities were also without precedent. In spite of these apparent difficulties, the scientific work at Camp Detrick has been outstanding in every respect.

Intelligence on Biological Warfare.

It was obvious that any evidence of enemy intentions regarding

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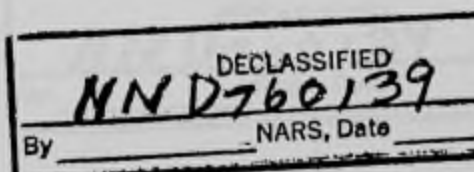
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the use of b.w., or any information regarding products which might be used, even though this information might be in the form of unsubstantiated rumor, would prove of value not only to our military leaders but also to the scientists engaged in the study of b.w. It was not the policy of WRS to serve as the collecting agency for such intelligence. It was, however, a responsibility of WRS to make certain that efficient measures were used in its collection, that the various intelligence agencies were properly instructed and alerted; and until b.w. became a matter of strategic military planning, that intelligence from all sources was placed in the hands of WRS for study and evaluation.

This task of education and liaison was undertaken by Mr. John P. Marquand, Director of Intelligence and Information of WRS. All intelligence material dealing with b.w. was obtained from G-2, ONI, Medical Intelligence SGO, OSS, and FBI. This intelligence was summarized and was then presented to scientists and intelligence specialists for evaluation and comment. While it was obvious that enemy activity in b.w. would be a closely guarded secret, the meager amount of information obtained led to the conclusion that responsible intelligence collection agencies might not be properly educated or alerted to the manifestations of b.w. After consultations with the Office of the Secretary of War, instructions emphasizing the importance of b.w. intelligence were sent by G-2 to all Military Attaches, and to Theater or Area Commanders in the British Isles, North Africa, the Middle East, China, Burma-India, and the Pacific.

When this alert failed to uncover further information, the Director of Intelligence and Information of WRS was sent abroad to consult with intelligence authorities and with the Theater Surgeons in all operational areas. As a result of this survey, WRS with the approval of the Office of the

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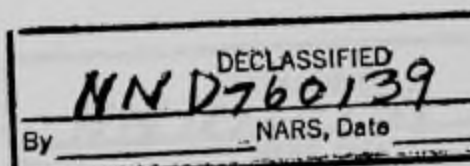
Surgeon General, made certain recommendations to the Secretary of War which were designed to facilitate the collection and dissemination of b.w. intelligence. It was also recommended that an officer be assigned to visit all operational areas to instruct responsible officers and to stimulate the collection of b.w. intelligence. The selection of such a "roving" intelligence officer was made by the Surgeon General of the Army and the Assistant Chief of Staff, G-2. This officer was sent first to the European Theater of Operations, and following completion of his duties there he proceeded to the North African, Middle East, Southwest Pacific, Burma-India, China, and Pacific Theaters to continue and complete the work of instruction.

At the suggestion of WRS, with the concurrence of the Secretary of War, a further intelligence project was initiated by the Office of the Surgeon General involving the collection and laboratory examination of blood samples taken from prisoners of war to determine whether these individuals had been immunised against b.w. agents which our enemies might possibly employ.

Information and Public Relations.

It was believed that one of the great dangers which might arise from enemy use of b.w. would be the creation of panic among the civilian population. Methods for handling this contingency were discussed with the Director of OWI, the Bureau of Public Relations of the War Department, the Director of FBI, and the Office of Censorship; and general plans for publicity counter-measures were agreed upon. A continuous survey of the nation's press and periodicals was instituted to detect any evidence of hysteria regarding epidemics which might spring up in various districts and to detect any leaks in security concerning our own activities. It was concluded that

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public speculation on the potentialities of b.w. should be discouraged as much as possible, but without placing undue emphasis on the subject matter. Largely as a result of the intelligent and whole-hearted cooperation of the nation's press and radio in helping to carry out this policy, the general public was not alarmed or unduly concerned over any phase of biological warfare.

Transfer of Responsibility for Work on Biological Warfare to the War Department.

In mid-December of 1943, the Office of Strategic Services informed the Joint Chiefs of Staff that information had been received indicating possible plans for use of biological warfare by the Germans. At that time it appeared that the Germans might possibly use their proposed cross-channel weapons to carry biological warfare agents into the British Isles. The Director of WRS was asked to serve as the Chairman of a Special Sub-Committee of one of the Committees of the Joint Chiefs of Staff to discuss the possible biological warfare aspects of this alleged enemy activity. Although intelligence on possible German activity in this field was meager and inconclusive, there had been sufficient work done in the United States, Great Britain, and Canada to indicate to this special Sub-Committee that such a means of attack was feasible. As a result of this conclusion, War Research Service suggested to the Secretary of War that the War Department should assume greater responsibility for the biological warfare research and development program. At the same time WRS asked the Chemical Warfare Service and the Office of the Surgeon General to accelerate work on protection of our forces against possible enemy use of biological warfare. These actions indicated the need to consider the possibility of biological warfare in strategic military planning.

In January of 1944 the Secretary of War directed the War Department

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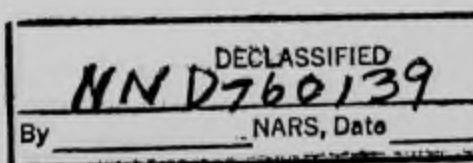
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to assume full responsibility for work on certain biological warfare agents; for the collection, evaluation and dissemination of intelligence on biological warfare; and for defensive measures against biological warfare. The Surgeon General was directed to cooperate with the Chief of the Chemical Warfare Service in matters pertaining to defense against biological warfare, and the continued cooperation and collaboration of the Navy was invited.

During the next six months an increasing amount of responsibility for work on biological warfare was transferred from War Research Service to the War Department. Finally, in June of 1944, the President directed the War Department to assume full responsibility for the research and development program, and for the functions previously performed by WRS. The Secretary of War then appointed the Director of War Research Service as his Special Consultant on Biological Warfare, and requested the Director of Research and Development and the Director of Intelligence and Information of WRS to continue to serve with Mr. Merck as Consultants to the Secretary of War. The Navy Department assigned Lt. Comdr. (now Comdr.) W. B. Earles, USNR, to serve as Mr. Merck's Technical Aide and Executive Officer. By August 31, 1944 responsibility for the research program sponsored by WRS had been transferred to the Special Projects Division of the Chemical Warfare Service.

On October 1, 1944, the Chief of Staff directed the Commanding General, Army Service Forces, to consult with Mr. Merck on matters of major policy, and to keep Mr. Merck in touch with important steps taken concerning biological warfare in order that he might give the Army Service Forces the benefit of his advice and assistance and, in turn, keep the Secretary of War informed. This directive further stated that biological warfare agents were not to be produced in quantity without War Department approval. The Commanding General, Army Service Forces, placed the responsibility for work

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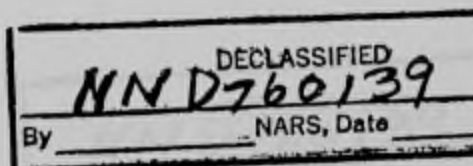


on biological warfare with the Chief of the Chemical Warfare Service, and asked the Surgeon General to cooperate in the development of certain highly important defensive measures.

At this time, the Secretary of War appointed the United States Biological Warfare Committee, with Mr. Merck as Chairman, to advise him on policy matters. This Committee was made up of representatives from the Chemical Warfare Service; the Office of the Surgeon General, U. S. Army; Bureau of Medicine and Surgery, U. S. Navy; Bureau of Ordnance, U. S. Navy; Army Service Forces; Army Ground Forces; Army Air Forces; New Developments Division, War Department Special Staff; ACoS, G-2, and the Office of Strategic Services. The Committee was asked not only to make recommendations to the Secretary of War on all matters of major policy relating to b.w., but also to establish and maintain close liaison with British and Canadian authorities concerned with biological warfare.

When War Research Service was liquidated in June 1944 and all b.w. work was transferred to the Armed Forces, the ABC Committee of the National Academy of Sciences and the National Research Council which had advised WRS, was discharged. Upon request from the Secretary of War, the President of the National Academy of Sciences and the Chairman of the National Research Council formed a new Committee, which was designated as the DEF Committee, to advise the War Department on scientific matters relating to biological warfare investigations.

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**SECTION I**

**RESEARCH AND DEVELOPMENT IN THE SPECIAL PROJECTS DIVISION  
OF THE CHEMICAL WARFARE SERVICE**

**Introduction**

The origins and development of the biological warfare program have been dealt with in Part One. This is an account of the research and development work in biological warfare performed by the Chemical Warfare Service.

Late in November of 1942 the Chief of the Chemical Warfare Service, Major General William N. Porter, was given verbal instructions to make preparations to carry on a supplemental research and development program on certain projects which were at that time being investigated under the sponsorship of WRS. The Chemical Warfare Service had made preliminary preparations for work in this field as early as 1941, when<sup>a</sup> Medical Research Division was established in the Office of the Chief for the purpose of carrying on studies in this field. Officers from the Medical Research Division were largely responsible, in cooperation with the WBC Committee, for the preparation of the annotated bibliography of the literature on b.w. which proved to be of such great value in the work of the WBC Committee.

The Medical Research Division was later called the Special Assignment Branch, which in turn developed into the much larger organization known as the Special Projects Division.

Early in 1943 the Chemical Warfare Service received a request from WRS to carry on supplemental research and development work on certain b.w. agents. This request brought about a tremendous expansion in the personnel, installations and equipment of the Special Assignment Branch,

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At this time the Office of the Surgeon General was asked to cooperate in the studies on defense against biological warfare attack. The Bureau of Medicine and Surgery of the Navy also signified its willingness to cooperate in the research and development program. A more complete history of the activities of the Office of the Surgeon General may be found in Section II; the contributions of the Navy in this field are described in Section III.

The first task which confronted the Special Projects Division was to design, construct, equip, and staff laboratories and pilot plants in its Camp Detrick installation. The urgency of the work was so great that laboratory and pilot plant work was started on a small scale almost immediately. The research and development activities of the program progressed and expanded simultaneously with the construction of new facilities. This expansion in program and facilities continued until V-J day.

#### Liaison and Consultation

From the beginning, the Special Assignment Branch and later the Special Projects Division maintained close liaison with the Medical, Ordnance, and Intelligence Departments of the Army and Navy; the Army Air Forces; the Army Ground Forces; the U. S. Public Health Service; the U. S. Department of Agriculture; and with British and Canadian investigators. In addition, the Special Projects Division constantly made use of the advice of prominent scientists working in many different fields in Government, and in university, private research, and industrial organizations. This was done largely with the help of War Research Service, the National Academy of Sciences and the National Research Council, the National Defense Council, the National Defense Research Council, and the Office of Scientific Research and Development. Some of the research personnel loaned to the British b.w. installations were furnished by the Special Projects Division. In addition,

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a liaison office concerned with b.w. matters was maintained by the Chemical Warfare Service in the United Kingdom, and trained b.w. officers were sent from the Special Projects Division to serve with our forces in all theaters of operation.

Numerous individuals of prominence in related scientific, engineering, and technical fields were employed as consultants to the Special Projects Division. Their advice was invaluable in helping to solve many technical problems.

#### Research Contracts

In order to pursue fundamental or highly specialized research, approximately 25 research contracts were made with various universities, state and federal Government agencies, and with individuals—first indirectly through WRS, and later, directly by the CWS. Those research projects which yielded promising results were ultimately taken over by the Special Projects Division for further development. In many cases the investigators by outside agencies yielded information of great value.

#### Personnel

Personnel of the Special Projects Division at the time of its maximum development totaled 511 officers, 3282 enlisted men and women, and 94 civilians. Army personnel included 365 officers and 2446 enlisted men and women; Navy personnel, 126 officers and 836 enlisted men and women. Some difficulties were experienced in obtaining personnel qualified in the various sciences and specialities involved, but the group which was obtained was organized and trained to work efficiently and rapidly under hazardous conditions and under the handicap of the strictest security control. It is particularly gratifying to point out the high degree of harmony and teamwork which existed at all times between Army, Navy, and civilian

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personnel, who worked side by side in each of the four installations of the Special Projects Division.

Installations of the Special Projects Division

Installations of the Special Projects Division included the parent research and pilot plant center established in April 1943 at Camp Detrick, Frederick, Maryland; a plant designed for larger scale production, acquired early in 1944, at Vigo near Terre Haute, Indiana; and field testing facilities established in the summer of 1943 at Horn Island near Pascagoula, Mississippi, and, in the summer of 1944 at Granite Peak, Dugway, Utah. Field tests were also conducted in collaboration with the Army Air Forces at certain of their installations. The buildings and equipment of the Special Projects Division's installations were in many instances unique, and required special designing to meet the completely new problems under investigation. The engineering problems encountered were particularly complex, due to the rigid safety requirements and to the necessity for designing, constructing and installing equipment needed for operations in an entirely new field, and on a scale of operation never before attempted.

Protection of the Health of Personnel

Before investigations of pathogenic agents could begin it was necessary to develop and apply safety procedures which would reduce to a minimum all chances of accidental infection of humans, animals, and living plants in each installation and in the surrounding areas. This was accomplished by various methods. Where possible, preliminary studies were carried on with harmless simulant agents in order to improve and standardize the techniques to be used in the investigations on disease-producing agents.

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Many laboratory techniques that had long been considered safe for handling pathogenic agents were found to be faulty and had to be revised or replaced by new procedures. Remarkable contributions to such studies were made by the photographic laboratory of Camp Detrick where, by the use of special high speed photography techniques, many accepted laboratory practices were shown to cause serious and previously unsuspected contamination of the surroundings. Rigid inspections and many original sampling procedures were instituted and maintained in order to detect contamination from leaks or faulty techniques. Specially designed protective clothing, masks, and other equipment were developed and provided, and their use was made compulsory. In addition, special decontamination procedures were developed and employed to destroy any pathogens which might escape. Immunization of personnel was accomplished whenever this was possible, and individuals so treated were regularly examined to ascertain the efficacy of the prophylaxis employed. When exposure to pathogenic agents was known or suspected to have occurred, or when suspicious signs or symptoms of disease appeared, the individuals affected were promptly given prophylactic treatment and placed under constant observation. The medical care and treatment of suspected or proved cases is described elsewhere in this report. The success of the safety program stands as a remarkable achievement, when consideration is given to the variety of highly pathogenic agents involved, their production and manipulation on a scale hitherto unknown, and the relatively large number of personnel engaged in the work. Original design, installation, and special modification of pilot plant and production equipment, of plumbing and of ventilation facilities, and the decontamination and disposal of enormous volumes of contaminated air, and of liquid and solid wastes, were remarkable and essential contributions of the engineers in affording protec-

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tion to the personnel of the installations and the human, animal, and plant population in contiguous areas.

Physical and Chemical Protection.

Certain standard items of CWB protective clothing, canisters, and masks were found to afford inadequate protection against b.w. agents, and recommendations based on extensive study were made for the improvements needed to make this first line of defense effective. Outlet valves for the mask and outlet valve covers were devised to reduce the hazards of leaks at this point, and efficient protective hoods were developed to protect the wearer's head against contamination. Methods for the decontamination of fabrics, footwear, clothing, equipment, rooms and other enclosed spaces, terrain, food, and water were investigated, and—while not yet concluded—these studies have yielded information of great value. A new and promising development under investigation is the impregnation of clothing with inert material to reduce its permeability to b.w. agents.

Detection.

In addition to the sampling and identification techniques devised and employed to detect contamination in the various b.w. installations, continuous effort was directed toward the development of simple and rapid sampling, screening, and identification methods for field use so that employment of b.w. by the enemy might be quickly detected. Significant progress was made, but many difficulties inherent in this important problem still await solution. From the beginning of the recent Japanese balloon attack, all equipment salvaged from the balloons was examined for the possible presence of b.w. agents. These investigations were performed at Camp Detrick, and happily yielded negative results.

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B.W. Agents Investigated.

The primary object of the research and development work on biological warfare was to develop methods for defending this country, our armed forces, and our allies against possible enemy b.w. attack. However, it was realized that if such an attack occurred, we might be called upon to retaliate in kind. In any event, it was obvious and essential that the offensive possibilities of biological warfare would have to be investigated in order to determine how to defend ourselves against all possible forms of attack.

All possible living agents, or their toxic products, which were pathogenic for man, animals, and plants were considered. When a potentially important biological warfare agent was selected for investigation, it was necessary to obtain and study the most virulent strain or type of that agent. The next problem was to discover or devise the optimal conditions for growth in order to obtain a satisfactory yield of virulent organisms or toxins. Continual efforts were also made to develop more virulent strains of the agents under investigation. After an effective method had been worked out for growing and harvesting the organism or toxin, prolonged studies were necessary to determine how well the agent would retain its disease-producing powers under various storage conditions. Each potential biological warfare agent had to be tested on various experimental animals exposed or inoculated by all possible methods or routes to determine species susceptibility and the influence of route of entry, and from these findings the probable pathogenicity of the agent for man estimated. Similar studies were made to determine the efficacy of biological, physical, or chemical protective procedures.

From these studies there has emerged a wealth of new and valuable

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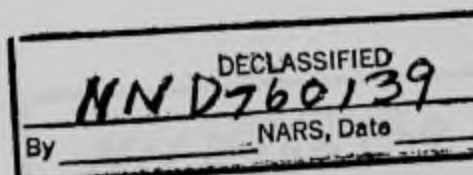
information of importance to human and veterinary medicine. For example, a pure crystalline bacterial toxin was isolated for the first time, making possible the future preparation of a pure toxoid for the immunization of man against the toxin. (This same toxoid, in a less concentrated form was produced in quantities sufficient to protect our troops from this agent had its use been necessary.) Promising leads were also uncovered pointing to the probable isolation and production of hitherto unknown substances of potential value for the immunization of humans and animals against several infectious diseases. With animals, much valuable information was also obtained regarding the numbers of organisms required to produce a given infection, and the influence of the portal of entry to the body upon the rapidity and course of the disease. The efficacy of new antibiotics and chemotherapeutic agents in the prevention and treatment of certain infectious diseases was demonstrated for the first time, not only in animals but in accidental human cases; and in the latter, invaluable observations were made on the incubation period and course of these diseases. Another new and significant study was performed on coagulants: chemicals applied with pathogenic organisms or toxins to influence their disease-producing powers. All of these developments, when made known by the publication of papers in scientific journals, will be recognized as highly important contributions to the advancement of science.

As a result of extensive studies on biological and chemical agents which might be employed in an attack upon our crops, many important and even spectacular results were achieved. The discoveries made in this field will undoubtedly prove of great value to agriculture.

Investigation of Means for Dissemination of B.W. Agents.

Studies on possible biological warfare agents would be incomplete

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without investigation of the means by which these agents might be employed in warfare. We had no first-hand knowledge on how biological warfare agents might be disseminated, hence studies had to be carried on in order to develop adequate defenses and to be in a position to retaliate in kind if necessary.

Theoretically, b.w. agents might be employed in sabotage operations, or disseminated by means of combat weapons. Sabotage would involve the use by stealth of such agents on a relatively small scale against the civilian population or military forces. In a sabotage operation, biological warfare agents might be used to contaminate water or food supplies, the air in ventilating systems, weapons to be used in assassinations, or certain pharmaceutical or biological products. The steps taken to protect the civilian population against possible sabotage have been outlined in Part One. The United States Public Health Service cooperated actively in this program. The United States Department of Agriculture carried on the work of protecting animals and crops against possible enemy use of b.w. by sabotage or other means. The armed forces at home and in the field were given instructions through military channels regarding defense against possible enemy biological warfare attack.

With no background other than conjecture, it was thought that b.w. agents might be disseminated by enemy action through the use of infected bullets and other missiles, shells, airplane bombs, dusts or sprays, the dropping of infected materials such as foods, or by the introduction of vectors of disease.

The absolute necessity for adequate field tests of the various possible means of dissemination was recognized from the beginning. Field-test areas were established in conjunction with the other facilities at Camp

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Detrick and Vigo, and the Horn Island and Granite Peak (Lugway) installations were developed and staffed entirely for this purpose. At Horn Island and at Granite Peak, field-test areas of variable design were laid out, and ingenious, complicated sampling systems were installed. Accessory service laboratories and meteorological stations were provided at each installation.

Medical Aspects.

Post hospitals or dispensaries were located at each of the four Special Projects Division installations, and were staffed by both Army and Navy medical personnel. Too high commendation cannot be given to the medical personnel, and to the services which they represented, for the efficiency and effectiveness of their work. When accidental infections occurred each case received immediate treatment on the Post. All individuals were instructed to report to the hospital whenever symptoms of illness or actual lesions, however, small, appeared, as well as in instances where accidental exposure to a dangerous agent was believed to have occurred. Each exposed or infected individual was examined, given prophylactic or local treatment if necessary, and placed under observation. Special wards in the hospitals were provided for the proper isolation and treatment of cases of disease. It was here that the best and most up-to-date treatment, based in some cases upon special diagnostic and therapeutic procedures developed on the basis of experimentation on animals, yielded such gratifying results.

In the entire program of work, there were only 60 cases of proved infection caused by accidental exposure to virulent b.w. agents. Fifty-two of these cases recovered entirely, and of the remaining 8 cases, all are well on the road to recovery at this time.

In addition to the proved cases indicated above, there were 159 accidental exposures to various b.w. agents in unknown concentrations. With

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one exception, all received immediate prophylactic treatment, and none of these developed an infection. The excepted individual did not report exposure, did not receive prophylactic treatment, developed the disease, but recovered following treatment.

While this outcome can in no way be considered the result of controlled experimentation, it indicates that the prophylactic and therapeutic treatment employed was largely responsible for the outstanding record which was made, particularly since the treatments used were, to a large extent, those which had proved effective in controlled experiments on animals. Additional valuable knowledge regarding the period of incubation and course of the disease following known exposure to b.w. agents was gained from a study of these accidental infections.

Special Biological Warfare Instruction for Officers.

A special biological warfare school was established at Camp Detrick in February 1944, and functioned for a period of four months. During this time, five 2 to 3 week sessions were held, and 70 Army Medical Officers from ASF, AGF and AAF; 115 Chemical Warfare Service Officers from ASF, AGF and AAF; and 32 officers of the Navy Medical Corps were given instruction in the fundamentals of biological warfare. The total of 217 officers who attended the b.w. school were given instruction on biological warfare intelligence, methods of detection, means of protection, clinical and laboratory diagnostic procedures, epidemiology, fundamental information on b.w. agents and their production, and a discussion on possible tactics which might be employed by the enemy in a b.w. attack. Although most of the graduates of these school sessions returned to their previous assignments, they constituted an informed reserve which was available for duty in

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the event of a b.w. attack by our enemies.

Theater B.W. Officers.

Officers selected from the Special Projects Division, or from the group trained in the b.w. school, were assigned to duty in each of the major theaters of operation as theater and liaison biological warfare officers. It was the duty of these officers to inform the staff of each Theater Commander regarding all new developments in the field of biological warfare and to stimulate the collection and dissemination of intelligence on enemy b.w. activities.

Intelligence on Enemy B.W. Activities.

In January of 1944 the War Department directed the Chemical Warfare Service to organize a strong and aggressive organization to assume responsibility for b.w. intelligence. The Biological Warfare Intelligence Branch of the Special Projects Division, CWS, was created to carry on the important duties of collection, evaluation and dissemination of all b.w. intelligence. The Intelligence Branch was also made responsible for the over-all supervision of security measures in each of the various installations of the Special Projects Division. In order to collect, evaluate and disseminate intelligence on b.w., the Intelligence Branch established liaison with the service and civilian agencies which might uncover information of interest in this field. The foundations laid by WRS were used as a basis on which was built an active and effective cooperation with G-2, ONI, OSS, and FBI.

Military Attaches assigned to duty in strategically located capitals, as well as the intelligence officers sent to the various theaters of operation to concentrate on the collection and dissemination of medical and other technical intelligence, were given sufficient instruction on b.w. to

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acquaint them with all possible manifestations of enemy b.w. activity. Questionnaires were prepared and distributed to the theaters of operation to be used by qualified intelligence officers in the questioning of prisoners of war in an attempt to obtain more direct information on enemy intentions and capabilities in this field. All of the intelligence on b.w. was sent to Washington where it was carefully studied and evaluated and then distributed to the services concerned. As the time approached for major military operations in Europe, and later in the Pacific Area, officers with special training in b.w. were attached to the staffs of the Theater or Area Commanders. In this manner, the staffs were kept informed of any possible use of b.w. by the enemy and were provided with trained advisers if the necessity arose for our forces to defend themselves against this form of attack.

As one phase of a special G-2 activity, officers who were well trained in b.w. work were assigned to duty in re-occupied or conquered territory to investigate enemy b.w. activities. In Germany, this special team of b.w. officers was joined by officers representing the British b.w. organization in a highly successful operation which yielded a complete, documented account of German biological warfare activities. At present a similar investigation of Japanese biological warfare activities is in progress.

In the collection of intelligence on b.w. many unusual and even fantastic pieces of information were transmitted to Washington. All of the intelligence received was studied with great care in order to distinguish between that which might be based on fact and that which indicated an effort on the part of our enemies to wage a new form of psychological warfare. Review of the intelligence received indicates that our enemies made several attempts to use b.w. as a weapon in a war of nerves.

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Counter-Intelligence.

From the beginning, all work on b.w. in the United States, the United Kingdom, and Canada was carried on under the strictest security control. It was believed necessary to maintain complete secrecy not only to keep our enemies from obtaining information on our work, but also to keep the public and the members of our armed forces from being unduly concerned over the possibilities of biological warfare. As the b.w. program of the Special Projects Division developed, it was necessary to establish and maintain strict security regulations and control in all installations and institutions where work was being performed. All personnel engaged in or associated in any way with the b.w. program were thoroughly investigated by PMCO, G-2, ONI and FBI; their eligibility for participation in the program depended upon their being cleared by these agencies. The counter-intelligence work also involved investigation of reported leaks in security; the establishment and maintenance of security in the purchase and shipment of critical equipment and supplies; the investigation and protection of scientists engaged in the program; and the classification of all correspondence and documents. In order to perform these important counter-intelligence duties, specially trained intelligence officers and staffs were maintained at each of the installations of the Special Projects Division. Some idea of the task involved may be gained from the fact that over 6,000 people were cleared for work on the program. In order to check on the degree of security maintained, periodic surveys of the areas surrounding installations or institutions in which work on b.w. was performed were conducted by the Counter-Intelligence Corps of the Army and by the FBI. These surveys indicated that security was maintained; the thousands of workers involved took their war-time responsibilities seriously and did not talk about their

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work. Another indication of the success of our efforts to maintain security was found in an official German document captured after V-E day which revealed that after the spring of 1942 no information was received in Germany regarding work in the United States on biological warfare.

Japanese Balloon Attack.

When it first began, the Japanese balloon attack on the United States and Canada was recognized as a method by which the Japanese might wage biological warfare. It was thought that the Japanese might send causative agents of human, animal, or plant diseases as the "pay load" of the balloons, and that the most serious threat might be against the animal population. An effective b.w. attack on our livestock would have reduced the supply of meat to a dangerously low level. A special team of biological warfare officers was sent to each of the defense and service commands to alert responsible officers to the potential dangers, to give instructions regarding the collection of samples for analysis, and to establish procedures to be followed in reporting balloon incidents. Military plans for defense against possible enemy b.w. attack were prepared and coordinated with the protective activities of the United States Public Health Service and the United States Department of Agriculture. The United States Public Health Service alerted its detecting and reporting services throughout the nation in order to accelerate the flow of reports on any epidemic of human disease. Similar action was taken by the United States Department of Agriculture to accelerate detection of, and reports on, epidemics of animal disease. In addition, the Department of Agriculture continued the emergency plant disease and insect pest surveys which had been instituted in 1942 at the request of WRS in order to guard against the spread of plant diseases or insect pests which

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might be introduced by the Japanese balloons. The work of the military services, the U. S. Public Health Service and the U. S. Department of Agriculture was coordinated with similar activities in Canada. Throughout the period of the Japanese balloon attack, these detecting and reporting services functioned efficiently. The analyses which were performed on equipment recovered from the balloons in all cases yielded negative results. The work was performed under a carefully maintained cover of security in order to avoid alarming the public over a danger which fortunately did not materialize.

#### SUMMARY

The various activities of the Special Projects Division and the organizations which cooperated with it in work on b.w. were extensive in scope, but at the same time highly intensive in character. The problems dealt with were new and unique, and at all times the work was carried on under the pressure of great urgency. Starting from scratch, it was necessary rapidly to develop methods and to provide measures for defense against a potentially dangerous method of warfare.

Apart from the military objectives attained in this work, much information of great value to public health, human and veterinary medical science, the fundamental sciences, industry, and agriculture was derived from the research and development work performed. In addition, new and unique facilities were designed and constructed which are of great potential value to peace-time military and non-military research. Some of the more important accomplishments of the research and development program follow:

1. The development of methods and facilities for mass production of microorganisms and their products. In this work, much information of fundamental scientific importance was obtained regarding the nutrition and conditions for growth of microorganisms, and procedures were developed to

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permit the production in safety of quantities of microorganisms never before believed possible.

2. The development of methods for the rapid and accurate detection of small numbers or minute quantities of disease-producing agents.

3. Significant contributions to knowledge of the control of air-borne disease-producing agents.

4. The production and isolation for the first time of a crystalline bacterial toxin, opening the way for the preparation of a more highly purified immunizing toxoid.

5. Development and production of an effective toxoid in quantities needed to protect our troops at the time of the liberation of France. Use of this toxoid was not necessary but it was prepared and available for use if the enemy had elected to wage biological warfare at that time.

6. Significant contributions to knowledge concerning the development of immunity against certain infectious diseases of humans and animals.

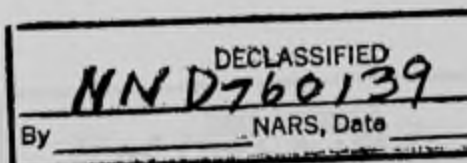
7. Important advances in the treatment of certain infectious diseases of humans and animals, and in the development of effective protective equipment and clothing.

8. The development of laboratory animal propagation and maintenance facilities at Camp Detrick and at the Vigo Plant to supply the tremendous number of approved strains of experimental animals needed for the investigation.

9. The application of special photographic techniques to the study of air-borne microorganisms and the safety of laboratory procedures.

10. Information on the effect of over 1,000 different chemical agents on living plants. It is anticipated that the results of this work

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will be of great value to agriculture.

11. Studies on the production and control of certain diseases of plants. This work is also of great potential value to agriculture.

The results of the scientific work performed in the biological warfare research and development program will be published in the scientific journals, and will thus become available for application in the fields of public health, agriculture, industry, and in the fundamental sciences.

The work which has been done indicates that biological warfare is feasible, and that it represents a distinct threat to those nations which ignore its potentialities. We have learned that continuing study is needed to provide for adequate defenses against biological warfare, and that to study defense it is also necessary to investigate all of the offensive possibilities of biological warfare.

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**Section II**

**ACTIVITIES OF THE OFFICE OF THE SURGEON GENERAL IN  
DEFENSE AGAINST BIOLOGICAL WARFARE**

**Introduction**

It is the duty of the Surgeon General to protect and maintain the health of the Army and of personnel working in Army installations. As pointed out in Part One, several officers of the Medical Department were concerned years before the outbreak of war over the possibility that our potential enemies might use biological warfare against us and suggested study of the means which could be used to guard against such an attack. The warnings transmitted by these officers to the War Department helped to stimulate the actions which were taken to investigate the possibilities of biological warfare.

**Application of Normal Activities and Functions**

As the research and development program in b.w. expanded, the normal activities and functions of various services or divisions of the Surgeon General's Office, under Major General Norman T. Kirk, were applied to the particular defensive and therapeutic problems which this work created. It became necessary to investigate and to authorize the use of certain non-standard biologicals and therapeutic procedures. Advice on many medical and technical problems was provided upon request of those actively engaged in the program. Advice was given on the construction of hospitals and laboratories. Special medical supplies and hospital equipment were obtained for the installations of the Special Projects Division, CWS. Manuals of instruction for medical and laboratory workers participating in the defensive aspects of the b.w. program were prepared by the Office of the

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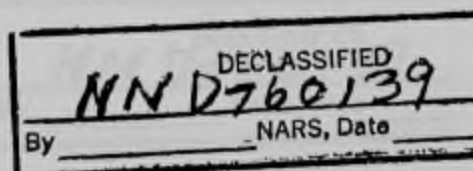
Surgeon General. The Medical Intelligence Division of the Preventive Medicine Service participated actively in the collection, evaluation and dissemination of information on enemy intentions and capabilities in b.w.

Development of Specialized Activities

The Preventive Medicine Service, the Veterinary Division, and the Medical Consultants Division had the chief responsibility for the activities of the Office of the Surgeon General in b.w. work. During the rapid expansion of the research and development program in 1943-1944, War Research Service was asked to furnish a consultant who could carry on effective liaison between the Office of the Surgeon General and the Chemical Warfare Service, assist in the administration of b.w. affairs in the Surgeon General's Office, and help to supervise work on the defensive aspects of the entire program. The work of this consultant and his successor proved of great value to the success of the program.

The Office of the Surgeon General was represented on all committees established to investigate, advise or take action on biological warfare matters. In addition, the Surgeon General's Office was at all times consulted on defensive matters by WRS, the Office of the Secretary of War, and CNS. The Office of the Surgeon General was consulted by Joint Security Control regarding the security classification of subject matter relating to b.w. A Sub-Committee of the Joint Chiefs of Staff called upon the Office of the Surgeon General early in 1944 for advice on defense against possible enemy use of b.w. The Secretary of War requested the Chief of the Veterinary Division to serve as Chairman representing United States interests on the Joint U.S.-Canadian Commission established to investigate defensive measures against certain diseases of livestock. The Chief of the Veterinary Division also served as the Chairman of the Commission which administered the

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work done in the United States on defense against other diseases of domestic animals. Thus, the Office of the Surgeon General participated actively both in the formation of policies and in the performance of investigations in the work on defense against biological warfare.

The Anti-Biological Warfare Programs in Hawaii, the Panama Canal Zone, the United States, and Theaters of Operation.

The Office of the Surgeon General and Medical Department Officers in the field played a major part in the initiation and continuation of the anti-biological warfare programs. In this work, officers of the Medical Department cooperated actively with the Office of the Provost Marshal General and with the Navy. The anti-b.w. program involved not only the instruction of Medical Department and Security Officers on all matters relating to detection of, and defense against, possible b.w. attack; but it also necessitated active participation and continued vigilance on the part of Medical Officers. The anti-b.w. program was expanded to include all Theaters of Operation in addition to the United States, Hawaii, and the Canal Zone. There is no evidence that our enemies at any time attempted a biological warfare attack, but the anti-biological warfare program that was developed and kept in readiness insured that such an attack, if made, could not have met with success.

Testing of Prisoner of War Blood Sera for Specific Antibodies.

In 1943 at the suggestion of WRS, the Office of the Surgeon General initiated the testing of blood sera taken from prisoners of war to determine whether these prisoners had been immunized against certain diseases. It was believed that if our enemies were planning to use the causative agents of infectious diseases in a b.w. attack, they would first immunize their own troops against these diseases. Determination of whether such immunization had been performed might therefore provide some indication of enemy inten-

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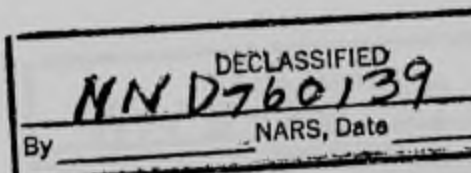
tions. Samples of blood were taken from prisoners as a routine procedure during physical examination, and fractions of these samples were sent to various laboratories where the necessary tests could be made to determine their antibody content. Although no significant positive tests were revealed by this extensive and complex study, this procedure was another form of insurance against the success of a potential enemy biological warfare attack.

Cooperation with the Chemical Warfare Service in the  
B.W. Research and Development Program.

With the establishment of Camp Detrick in the spring of 1943, the research and development work on b.w. expanded rapidly and continued to expand until V-J day. The Office of the Surgeon General was asked to cooperate actively with the Chemical Warfare Service in the supervision of the research on immunology and therapeutics of diseases which might be due to b.w., and was given responsibility for the procurement, storage, and issue as required of biologicals (vaccines, toxoids, and anti-sera, etc.) designed and developed to protect personnel against possible b.w. agents. To handle this added responsibility and to carry on increasing activities in the defensive field, a B.W. Committee was constituted in the Office of the Surgeon General. This committee was made up of representatives of various services and divisions, who served with the Special Consultant on b.w. matters, to advise the Surgeon General regarding policies and procedures. As indicated in Section I, the hospitals and dispensaries of the b.w. installations were staffed with Army and Navy Medical Department personnel. The work of these representatives of the Medical Department, and of all others engaged in the defensive aspects of the research program, was coordinated and guided by the Surgeon General's Committee and by special liaison officers.

Early in 1944 when it appeared remotely possible that a biological

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warfare agent might be employed by the Germans, the Surgeon General's Office undertook the procurement and storage of a product which could have been issued to protect our troops against one of the agents if it had been used. This product had been developed by the combined efforts of WRS and CWS research. It was manufactured first at Camp Detrick, and later by commercial biological concerns under the supervision of the Surgeon General's Office. In actual fact, the biological warfare agent was never used by the Germans, and hence it was unnecessary to immunize our troops against this agent, but again the work which was performed may be considered as insurance against a potential danger. The collaborative work of the Surgeon General's Office and the Chemical Warfare Service was continued in the development of additional products which were used to immunize workers at installations of the Special Projects Division and were available for large-scale use in the field, if necessary.

The work of the Medical Department in defense against b.w. was eminently successful. The means of protection, immunization and treatment of personnel were so effective that in the entire program of work, in which over 4,000 persons were engaged, there were only 60 cases of disease caused by accidental exposure to virulent b.w. agents. All of these cases have recovered or are well on the road to recovery. In addition to these results of immediate significance, a wealth of information of value to medical and veterinary science, and to preventive medicine was obtained.

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**Section III**

**ACTIVITIES OF THE NAVY IN THE BIOLOGICAL WARFARE PROGRAM**

**Introduction**

The Navy participated in the first preliminary discussions on the potentialities of biological warfare and contributed on an increasing scale to the research and development program as it expanded. The Chief of Naval Operations, the Bureau of Medicine and Surgery, Bureau of Ordnance, Bureau of Ships, Bureau of Naval Personnel, Bureau of Aeronautics, Office of Naval Intelligence, Office of Research and Development and the Naval Research Laboratory all contributed to the progress which was made in b.w. work. However, from the beginning, the Bureau of Medicine and Surgery was the principal participating agency, and made the greatest contributions to the success of the program.

At first, the Chief of the Bureau of Medicine and Surgery, Vice Admiral Ross T. McIntire, and officers chosen to represent him, worked with the WBC Committee of the National Academy of Sciences and the National Research Council to investigate the possibilities of biological warfare. From the time that War Research Service was established in the summer of 1942, the Chief of the Bureau of Medicine and Surgery was consulted by the Director of WRS on all major decisions and plans. Specially qualified officers were assigned by the Bureau of Medicine and Surgery to work with WRS, and to service on the ABC Committee of the National Academy of Sciences and the National Research Council, which was formed to advise WRS. Plans were made to convert one of the Navy Medical Research Units to a b.w. experimental station. The technical director of the work sponsored by the Joint U.S.-Canadian Commission

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was assigned from the Bureau of Medicine and Surgery.

When the War Department assumed full responsibility for work on b.w. the Navy was requested to increase its participation in the program, and the Chief of the Bureau of Medicine and Surgery and the Chief of the Bureau of Ordnance was asked to serve on the Secretary of War's U.S.B.W. Committee. The Naval Unit, which had been established at Camp Detrick to help in the work of the Special Projects Division, CWS, was increased in size, and Naval Units were formed in the other installations of the Special Projects Division. The Navy was represented on the DEF Committee of the National Academy of Sciences and the National Research Council. This Committee was created to advise the Services engaged in the b.w. program on scientific matters. When the Director of NRS became Consultant to the Secretary of War on biological warfare matters, the Bureau of Medicine and Surgery assigned an officer to serve as the Consultant's executive officer and assistant. This officer also served as scientific adviser to the U.S.B.W. Committee, and as Secretary of the DEF Committee. The Bureau of Medicine and Surgery also established a Special Projects Section in its Preventive Medicine Division to effectuate close liaison with the medical work of the Special Projects Division, CWS, and the Office of the Surgeon General of the Army, to assure protection of the health of Naval personnel, and to provide additional medical guidance to the entire program.

Thus, it may be seen that as the research and development work in the field of biological warfare progressed, participation by the Navy in the effort developed to such an extent that the program became truly a combined operation.

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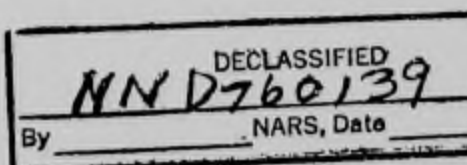
The B.W. Work of U.S. Navy Medical Research Unit No. 1.

Acting on the basis of recommendations by the WBC Committee and special panels appointed by WRS, the Bureau of Medicine and Surgery late in 1942 started the conversion of U. S. Navy Medical Research Unit No. 1 in Berkeley, California, to work on one phase of the biological warfare program. This Unit was established originally to study air-borne infectious diseases, particularly those of the respiratory tract. The Unit was admirably located, staffed, and equipped to investigate one particularly dangerous biological warfare agent. U. S. Navy Medical Research Unit No. 1 started its research program in the field of biological warfare in April of 1943 with the help of WRS. Upon liquidation of WRS in July, 1944, full support of the work of this Unit was assumed by the Bureau of Medicine and Surgery. The research and development program of this Unit was closely coordinated at all times with that of the Special Projects Division of the Chemical Warfare Service. It grew in size from a total of 12 officers and 8 enlisted men in April of 1943 to 19 officers and 45 enlisted personnel at the end of the war. The research and development work which was carried on resulted in significant contributions to knowledge on the nutrition and growth of the organism under investigation, its retention of viability and virulence under various conditions of storage, the influence of the portal of entry upon the ability of this organism to produce disease, and the efficacy of protective and therapeutic measures. Many techniques were developed in these investigations which will be of great value in continuing work on air-borne infectious agents.

Cooperation with Canadian and British B.W. Activities.

In the summer of 1942, when a joint U.S.-Canadian Commission was created by the governments of United States and Canada to establish and admin-

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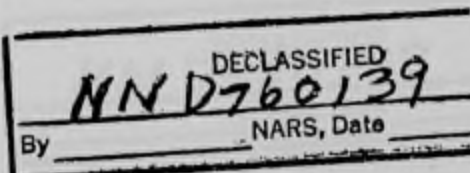
ister a program of research on protection against a potentially dangerous disease of livestock, the first resident technical director appointed for this project was a Naval medical officer of the Bureau of Medicine and Surgery. Additional officer and enlisted Naval personnel were provided to assist the director. The Navy's participation in this work continued until the spring of 1944, at which time many of the fundamental discoveries necessary to the success of the project had been made.

Early in 1943 at the request of British authorities, the first three of several U. S. Naval officers later to follow were sent by the Bureau of Medicine and Surgery to the United Kingdom to receive training and to assist in the British biological warfare program. These officers were replaced at six to twelve month intervals in order to furnish the British with needed scientific manpower, and to train U. S. Naval officers in special techniques which had been developed in the United Kingdom.

Cooperation with the Chemical Warfare Service.

Shortly after the establishment of Camp Detrick as the principal research and development installation of the Special Projects Division, CWS, the Navy agreed to furnish approximately 25% of the technically trained personnel required to staff Camp Detrick and other installations of the Special Projects Division. In order to administer the Naval activities in each installation, it was necessary to establish a Naval Unit in the Special Projects Division, with subsidiary units in each of its installations. These Units were established by the Chief of the Bureau of Medicine and Surgery with the approval of the Chief of Naval Operations. The chief function of these Units was to assist the Chemical Warfare Service in every proper, practicable way to the end that the problems assigned the Special Projects Division, CWS, might be most satisfactorily and expeditiously solved. The Commanding Officer of the

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Naval Unit was requested to maintain close liaison with the Bureau of Ordnance in connection with all offensive aspects of the problems under investigation.

By the end of the war, the Naval Unit of the Special Projects Division, CWS was made up of 126 officers and 836 enlisted men and women. Thus, the Navy contributed 962 of the total of 3,887 officers and enlisted men and women engaged at that time in the work of the Special Projects Division. Each of the Naval officers who served in the Naval Unit of the Special Projects Division was requested specifically for this duty on the basis of his training and experience. This procedure resulted in the acquisition of a superior group of technically trained officers. The Bureau of Naval Personnel was most cooperative and considerate in filling requests for officers with specified qualifications. In fact, several officers were recalled from overseas duty for assignment to the Naval Unit.

Enlisted men and women were requested by rating for duty in particular job classifications. The majority of these were pharmacists mates who were trained as laboratory technicians, but many other ratings were supplied by the Navy on request from the Special Projects Division to perform special duties, and as a result, the Naval Unit contained carpenters mates, electricians mates, aerographers mates, machinists mates and motor-machinists mates, water tenders, ship fitters, firemen, seamen, and yeomen.

Although the personnel of the Naval Unit carried on their duties under the administration of a Naval organization, they worked at all times in the closest possible collaboration with the Army and civilian personnel in the installations of the Special Projects Division. Starting on December 1, 1944, the position of Technical Director of the Special Projects Division was filled by a Naval officer, and from the beginning, the position of Production Director was held by a Naval officer. In addition, other Naval

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officers served as division chiefs, branch chiefs, or as cooperating investigators. This wholehearted cooperation among Army, Navy and civilian scientists was truly outstanding and resulted in accomplishments which neither of the principal services would have been able to accomplish through its own efforts.

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